Burnout: The Cost of Masking Neurodiversity in Graduate STEM Programs

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Abstract

A growing body of literature suggests that neurodivergent individuals, such as those with autism, dyslexia, and ADHD possess unique abilities that may be assets in STEM fields. Despite the potential of neurodivergent students to leverage these abilities to contribute to innovation in their field, they face a multitude of barriers and difficulties as they navigate rigid educational environments. While there has been research on the strengths and challenges of neurodivergent STEM students at the undergraduate level, there is a lack of studies at the graduate level. This paper details findings from a qualitative study on the experiences of neurodivergent graduate students within their STEM programs. Findings from a series of 10 focus groups suggest that neurodivergent students face pressure to mask their neurodiversity-related traits and hide the challenges that they often face within their graduate program. Neurodivergent students often experience variations in attention, motivation, time management, and other elements of executive function; these variations may pose distinct challenges for neurodivergent students as they shoulder heavy workloads while attempting to maintain a healthy work-life balance. The findings from this study suggest that the additional pressure placed on neurodivergent graduate students to mask their experiences contributes to an unacknowledged cognitive and emotional load that may significantly impact their mental health in the form of anxiety and burnout. These findings have implications within the context of the advisor-advisee relationship, as variations in advising practices and communication styles may impact graduate students' perceived need to mask their neurodivergence. This paper aims to highlight the neurodivergent students' experiences with masking and the mental health challenges that neurodivergent students face as they navigate the demands of graduate-level STEM programs. It is anticipated that these findings may foster the adoption of inclusive advising practices for faculty advisors and program administrators and to enhance the educational experiences of neurodivergent students in graduate STEM programs.

Introduction

The neurodiversity in human populations includes a range of neurological variations such as attention deficit hyperactivity disorder (ADHD) and autism spectrum disorder (ASD), which are labeled neurodevelopmental disorders, as well as dyslexia, dysgraphia, and dyscalculia, which have been categorized as specific learning disabilities (SLDs) [1, 2]. Historically, research has focused on the deficits related to these neurological variations. However, recent research has reflected a growing interest in understanding the strengths associated with neurodiversity. A growing body of literature suggests that neurodivergent individuals may possess traits such as divergent thinking, risk-taking, creativity, or spatial visualization skills [3-7] that may be assets in STEM fields. Despite the potential of neurodivergent students to leverage these strengths to contribute to innovation in their fields, they face a multitude of barriers and difficulties while navigating a traditionally rigid academic environment in which they frequently encounter negative attitudes and stigma [8]. These barriers may increase the cognitive and emotional load of neurodivergent students pursuing advanced degrees in STEM fields, impeding their sense of belonging and success in their programs.

Despite efforts to increase the participation of marginalized students in STEM, neurodivergent students have remained underrepresented and underserved in STEM fields. While it is likely that many students do not wish to disclose their diagnosis, reports show that neurodivergent students make up only a fraction of the 1% of STEM graduate students who have a reported disability [9, 10]. Neurodivergent students continue to experience high rates of departure from college [10], lower-than-average levels of education [11] and a range of socio-economic challenges [11, 12] despite their comparable intellectual capabilities with neurotypical individuals [3, 4], [13-18]. While accommodations may help neurodivergent students succeed in higher education, many choose not to seek supports from their university's center for students with disabilities [19]. For example, one study [20] shows that fewer than 20% of engineering students with ADHD seek accommodations because they fear the stereotypes and stigma related to disability labels. Graduate students tend to rely even less on accessibility services than undergraduate students [21]. This may be due to the perception that accommodations will not be meaningful, as they are often geared toward the coursework needs of undergraduates, [3, 5]. Much of the current research literature about neurodivergent students focuses largely on undergraduate students. Thus, the literature about neurodivergent graduate students within the context of STEM education is limited.

While the general undergraduate student experience of students in STEM has been studied over the previous decade [22-28], similar attention has not been paid to the graduate student experience [29, 30]. Graduate students face a unique set of challenges, including pressure to publish, financial insecurity, a highly competitive academic job market, work-life balance, and hierarchical faculty-student relationships [31-33]. Additional challenges include a lack of transparency about university process; workload; role conflict [34]; the political landscape; and impostor syndrome [35]. Satterfield et. al [30]. noted that the pool of research on the graduate student experience in STEM was limited and compiled a comprehensive literature review in 2018 to set the stage for future work. The summary focused on the experiences of graduate students during their studies, and how individual factors (the influence of the student's advisor), programmatic factors (isolation and teaching assistantships), and external factors (work-life balance and family influence) influence their persistence in the field [30]. Berdanier et al.'s [36] study of social media forums found that among the factors influencing attrition in graduate engineering programs were the student's advisor, support network, and goals, the quality of their life and work, and students' perceptions of both program cost and how others perceive them. While these studies are valuable, the underrepresentation of neurodivergent students in graduate STEM fields suggests a set of unique experiences and challenges that may impede their success in their programs.

To address this knowledge gap, this research study was conducted to evaluate the unique experiences of neurodivergent graduate students in STEM fields. This qualitative study uses thematic analysis to examine the experiences of 25 neurodivergent students' in graduate STEM programs at a large, research intensive (R1) university. We hope the findings inform changes in individual advising styles as well as broader programmatic structures that may contribute to a culture that cultivates and values the diverse cognitive abilities of students rather than standardizing the educational experience according to normative expectations.

Theoretical Frameworks

We frame neurological variations as an important facet of human diversity that may enhance society's ability to address complex problems within STEM fields. Taylor, et al.'s [37] theory of complementary cognition suggests that cognitive diversity may strengthen the adaptability of human societies by making use of complementary cognitive strategies that balance societal needs for safety and risk-taking. We also draw on Chapman's [38] ecological model of mental functioning, which considers how individuals' neurocognitive variations contribute to human ecosystems to support persistence and adaptation. This approach provides a framework for viewing neurodiversity as an integral part of human adaptation and suggests that the inclusion of neurodivergent individuals in STEM fields may enhance our collective potential for innovation for the benefit of society [39]. We also take a strengths-based approach that emphasizes the assets related to neurodiversity, while acknowledging individual challenges and questioning the rigid conceptualizations of "normality" [40].

Researcher Perspectives/Positionality

Our motivation and approach to this work is shaped by the personal experiences of several authors with ADHD and/or dyslexia, as well as our experiences working with a wide range of neurodivergent students within the context of neurodiversity-centered engineering and STEM education research projects. Our own experiences have led us to take a strengths-based approach toward neurodiversity that is integrated into the study (i.e., through the use of affirming language in recruitment and in our interactions with study participants). We perceive that our shared experiences helped us open a safe space for neurodivergent graduate students to share their lived experiences. We also believe it is important to acknowledge that while our team does represent diverse perspectives in terms of gender, cultural background, and other social identities, our perspectives are informed, and in some ways limited, by our experiences as white individuals in the United States.

Project Overview

This IRB-approved, NSF-funded research project included ten focus groups of students who self-identified as neurodivergent and were pursuing advanced degrees in STEM disciplines at an R1 university in the Northeastern United States. Recruitment took place *via* an email that was shared through a listserv for all graduate students and an email from the university's disability services office. The focus group participants a) self-identified as neurodivergent, and b) indicated that they were completing a graduate degree in a STEM field. Degree programs were classified as STEM programs based on the university's list of STEM majors and/or their inclusion on the list of National Science Foundation Research Areas [41]. Two participants pursuing STEM-related fields in the School of Education and the School of Business were also included.

Participants

25 neurodivergent graduate students took part in at least one focus group, with 6 participating in two focus groups. The focus groups were scheduled by participant availability and ranged from 2 to 5 participants. The majority of participants were white women pursuing doctoral degrees. The reasons for the high representation of white women in this study are unknown. Participants were asked to indicate with which neurodivergent groups they identified. Just over half of the participants (52%) identified with ADHD and 5 participants (20%) self-identified as autistic.

Additionally, 52% reported a mental health condition. 12 of the 25 participants (42%), identified with more than one neurodivergent group or condition. It is common for neurodivergent conditions to co-occur [42- 44]. Demographic data for the 25 participants are summarized in Table 1.

Table 1: Summary of Demographic Information (Total N = 25)

School/College	**N (%)**
College of Agriculture, Health & Natural Resources	5 (20%)
College of Liberal Arts and Sciences	13 (52%)
School of Business	1 (4%)
School of Education	1 (4%)
School of Engineering	4 (16%)
School of Medicine	1 (4%)
Neurodiverse Identity/Group Reported	
Anxiety (generalized anxiety disorder or social anxiety)	13 (52%)
Attention deficit hyperactivity disorder (ADHD)	13 (52%)
Auditory processing disorder	2 (8%)
Autism spectrum disorder (ASD)	5 (20%)
Bipolar disorder	1 (4%)
Depression	6 (24%)
Migraine	1 (4%)
OCD (obsessive compulsive disorder)	2 (8%)
PTSD (post-traumatic stress disorder)	2 (8%)
Mental health (self-harm)	1 (4%)
Gender Identity	
Woman	17 (68%)
Non-binary/Gender non-conforming	2 (8%)
Man	6 (24%)
Race/Ethnicity	
Hispanic or Latinx	1 (4%)
Multiracial/biracial	2 (8%)
White	22 (88%)
Graduate Program	
MS (Master's degree)	6 (24%)
PhD (Doctoral degree)	19 (76%)

Note: 12 participants (48%) identified with multiple neurodiverse identities/groups.

Data Collection

The focus groups were guided by a semi-structured protocol of open-ended questions centered around the participants' experiences as students who identify as neurodivergent in graduate STEM programs. Sample questions include, "What has been your experience so far, as a student in your STEM graduate program?" and "What do you think someone needs to do to be successful in your graduate STEM program?" All focus groups were held virtually, via Microsoft Teams, and the videos were recorded and transcribed using Otter.ai [45]. The transcripts were edited for accuracy and pseudonyms were provided for each participant.

Data Analysis

Qualitative methods allow for systematically exploring "the inner experiences of participants," (Corbin & Strauss, 2015). In this study, we conducted a thematic analysis following the phases of activity described by Braun and Clark [46]: "1) familiarizing yourself with your data, 2) generating initial codes, 3) searching for themes, 4) reviewing themes, 5) defining and naming themes, and 6) producing the report" (p. 87). In this way, the raw data was examined for patterns to be systematically categorized and developed into themes that connect to existing literature or suggest new findings. To familiarize ourselves with the data, we read and re-read the transcripts. The initial codes were developed using an inductive coding process. The transcripts were coded collaboratively to ensure agreement about understanding of the data and six initial categories were identified. The initial findings were then presented to external experts who are engaged in the project as members of the advisory board. Visual mapping of the findings was used to develop the following themes: Masking Neurodiversity and Neurodivergent Burnout.

Findings

This research highlighted several areas of challenges for current neurodivergent students. This paper will focus on two of the most prominent and timely themes encountered, Masking Neurodiversity and Neurodivergent Burnout. These themes are discussed in detail in the subsequent sections. The findings suggest that graduate students who identify as neurodivergent may experience a lack of sense of belonging, an imbalance between work demands and personal life, and the development of mental health challenges such as anxiety and burnout. The fact that students' neurodiversity is invisible to others in the graduate school environment unless they choose to disclose it may result in a dissonance between students' sense of self and abilities. The stigma associated with disability labels contributes a heavy cognitive and emotional load as students mask neurodivergent traits and navigate decisions about disclosure of their neurodivergence.

Masking Neurodiversity

In this analysis, we found that the neurodivergent students in this study exhibited behaviors related to masking their neurodiversity and hiding their struggles, especially within the context of their advisor-advisee relationship. Masking may be defined as covering or modifying one's neurodivergent behaviors to blend in with neurotypical people [50]. Camouflaging to pass as neurotypical is associated with decreased mental health among neurodivergent individuals [51, 52]. Nancy, who reported an auditory processing disorder (APD) and an anxiety disorder,

described how daily efforts to mask her neurodiversity in front of her advisor contribute to her mental health challenges:

> I do this masking where I put on that I'm very together for - in front of her and I have all these plans, and my calendar is all marked, but then my day to day, I don't feel like that. So, like revealing that side of me, is something that gives me anxiety.

While some other marginalized groups of students may have similar experiences as they seek to avoid negative perceptions, bias, and stereotypes, we suggest that neurodivergent students may be particularly vulnerable to the power dynamics inherent to the advisor-advisee relationship, due to the assumptions related to intellectual ability within academia as well as the predominant perception of neurological diversity as a cognitive impairment. Additionally, since neurological diversity is invisible, students may be perceived as neurotypical if they do not disclose it. Thus, students may attempt to mask their neurodiversity to blend in with their peers and avoid negative perceptions. Many of the neurodivergent students in this study sensed that if deficit-based assumptions were applied to them, they might be perceived as less capable, lose funding or positions on research projects, or miss out on recommendations from faculty who are renowned experts in their field. Alexis, a student who identifies as autistic, describes how neurodivergent students feel they need to mute aspects of themselves to successfully navigate their program:

> And sometimes, like, professors don't have the skills or the knowledge to understand our perspectives… So, like, sometimes, the burden is placed on students to kind of like dull their personality or like, be a certain way, just so they can make it through the program… I know many people just in my program who hide it, because people who do mention it to faculty members are treated much differently. And so, it's kind of easier to just deal with it on your own and not tell anyone, and maybe struggle behind the scenes. But that's still sometimes better than letting them know and having them treat you much worse or much differently.

Many of the graduate students in this study perceived that disclosure of their neurodivergence would expose them to the threat of poor treatment, negative consequences, and discrimination and many particularly noted the impact on the advisor-advisee relationship and potential career outcomes. While the experiences of the individual students varied depending on the culture within their program and the attitudes of their faculty advisor, many students preferred to not share information about their neurodiversity with their advisor. The need for students to hide their diagnosis was, in many ways, tied to the perceived possibility of negative financial and career outcomes if they disclosed their experiences.

Another aspect of masking neurodivergent experiences involves hiding struggles in order to conform to norms related to productivity. As neurodivergent students may experience variations in attention, motivation, time management, and other elements of executive function, progress on research or writing tasks may not align with advisors' expectations in relation to deadlines and typical timelines for progress. For example, Marnie, who has ADHD, struggled with managing multiple tasks as she anticipated a distant deadline related to her research. Although she was not making steady progress on her project, she was ultimately able to complete a large amount of work in a short period of time in order to meet a deadline. However, she avoided communicating her experience with her advisor and went to great lengths to hide her uneven rate of progress.

This allowed her to maintain the appearance that she was working at the expected pace, rather than depending on the impending deadline to increase motivation and focus for the completion of the task. She said:

> But I also don't want to bring something up that will make them think about me differently. Because I know that I am capable, when I'm on top of things. But when I'm not on top of things, I can be a mess. And that's the reality that I know about myself, but don't like to acknowledge. And so, like this past month, it's been a lot more of like I'm trying to hide things, because I haven't been on top of things. And so, like that whole, like six weeks' worth of work that I should have done… I did in two days because I was meeting with him the next day, and I had to have stuff to show him. So, I stayed up all night to have stuff to show him because I didn't want to bring up why I wasn't getting things done with him in the first place.

The fear of negative perceptions related to their cognitive ability may also influence neurodivergent students' sense that they need to work harder and longer than other students. Several participants mentioned experiencing imposter syndrome, which may be described as the feeling that one is a fraud despite one's accomplishments [47]. And even though many graduate students may experience imposter syndrome at some point in their career, these feelings likely place a heavy burden on neurodivergent graduate students who may feel pressure to hide their challenges to prove that they belong in academia. As Ó Meadhbh Murray et al. [47] write, "Students expend time and energy doing emotional work to navigate imposter feelings with marginalized students experiencing more persistent and intense imposter feelings than their more privileged peers, often in response to, and reinforced by, the exclusionary atmosphere of the university" (p. 2). This feeling was summed up by Moira, who said:

> But I think that it also has to do with… imposter syndrome and me thinking… I have to take on all this stuff to prove that I am… capable and able to do that, I'm competent and… can be successful. So, sometimes I'll overload myself because of that.

This dynamic may lead some neurodivergent students to push themselves beyond what they believe is manageable to prove that they are capable. This burden, in combination with the effort spent on masking one's experiences and identity, may place an oversized load on neurodivergent students, ultimately placing them at high risk of mental health challenges and burnout.

The findings that a variety of neurodivergent students exhibited masking behaviors in the graduate school environment is of particular interest, since masking is primarily discussed in the literature and online communities related to autism, and to a lesser extent in relation to ADHD [48, 49].

Neurodivergent Burnout

The students in our focus groups noted that the increase in workload as compared to that of undergraduate studies placed a high demand on their organizational skills and contributed to both high levels of stress and poor mental health. Participants noted that the difference in workload intensified some of the neurodiversity-related challenges that they experienced in their undergraduate studies. Wendy, a student with ADHD, noted the heavy workload and how she

often neglected self-care in order to meet the expectations of the program, but she also commented on the frustrations that she experienced trying to force herself to work "in regimented time," like neurotypical peers. She said:

> I will work until everything is done and everything is beautiful and wonderful. And all of the things have been squared away and put where they belong, and it's wonderful. And if I have to not sleep for three days to do that, that's what happens… I didn't get professionally diagnosed until I was 25, 26. So I went through high school and college really frustrated all the time. I couldn't understand why I couldn't just work in like regimented time.

The students in this study demonstrated a pattern in which they worked long hours to meet the expectations placed on them by their program. Rather than prioritize their own needs for self-care and personal development, they often struggled to set boundaries with their advisor to maintain a healthy work-life balance. This pattern of behavior is highly concerning as it may be an additional contributor to burnout among neurodivergent students who already bear a heavy cognitive and emotional load. Ronnie speaks to this experience as she shares feeling that "it's difficult for me to stop doing anything… I will spend every waking moment of my day working and go to bed feeling guilty that I didn't do more." Even though she partially sees her OCD as an asset that allows her to work endlessly, she also describes how this prioritization of work leads to a lack of self-realization:

> My neurodiversity, and I've talked about this with my therapist, makes me a superhuman… the whole hard-working thing and getting things done on time and being punctual and doing things early. Yeah, that is the superhuman bit. I will work for hours and hours and hours until everything is done. But the piece of it that is not so good, is that I don't develop as a human being.... And that has other detrimental effects on my life. Because I only identify as - as a worker.

Several participants questioned their ability to manage their heavy workload while simultaneously perceiving that others do not struggle in the same way. For example, Jim, who is autistic and also reports an anxiety disorder and PTSD, wondered if "maybe it's not that way for neurotypical students." Alexis, who is also autistic, expressed the feeling that the graduate school workload may take a particularly heavy toll on neurodivergent students when she said:

> …some people might be able to do that for long periods of time and like maybe not experience burnout, but then other people might experience burnout more quickly with those things… But I think there's this expectation of like, you should just do X, Y, and Z and overload yourself, and you'll be fine, because everyone else has been fine doing that. But that would take me out longer. And I would need a longer period for recovering from that.

These students perceived that others were not experiencing the same level of challenge in managing the demands of their program, and that navigating graduate school exacted a terrible toll on their energy that went beyond what neurotypical students might experience.

Existing literature about the graduate student experience indicates rising rates of anxiety, depression, and burnout across the board [53, 54]. Even prior to the COVID-19 pandemic, which has contributed to high levels of stress, anxiety, and depression among college students [55, 56], one study found that 41% of graduate students showed moderate to severe anxiety and 39% had moderate to severe depression [57]. As our study participants' experiences were recorded during the COVID-19 pandemic, it is possible that their mental health challenges may have been amplified by increased isolation and anxiety [58].

It is known that graduate school is a high-stress environment that places students at risk of burnout, which may be described as a "work-related syndrome resulting from chronic exposure to job stress" that is marked by "emotional exhaustion, cynicism and depersonalization, reduced professional efficacy and personal accomplishment" [59]. Within STEM fields, this risk may be even greater, as students face tremendous pressure and are found to spend up to 80 hours a week on their schoolwork, often at the expense of their own self-care needs [54]. This high-stress environment likely has a disproportionately high impact on the wellbeing of neurodivergent graduate students, who may work long hours to compensate for challenges (such as differences in attention, time management, or reading ability), and also spend significant energy in masking their neurodiversity-related traits.

The literature suggests that autistic individuals in particular may experience elevated rates of anxiety, burnout, and even suicidal ideation in relation to their experiences with masking to cope with stressful environments (i.e., environments designed around neurotypical ways of being) [50, 60]. Additionally, it has been suggested that ADHD and PTSD may be underlying factors related to the development of chronic anxiety, emotional exhaustion, and burnout in stressful work environments [61]. The finding that a majority of students in this study, even those who did not report ADHD or autism, described some element of hiding or masking their differences from others within the graduate environment, indicates that students who identify as neurodivergent may carry a hidden load as they expend significant mental and emotional energy to hide their neurodiversity and the challenges that they face in higher education, and thus may be at higher risk of burnout from the overwork of graduate school than neurotypical peers.

Discussion

Implications for Faculty Advisors

The advisor-advisee relationship has a profound impact on the student experience, particularly for neurodivergent and other marginalized students. Faculty advisors who work with graduate students should seek opportunities to increase their awareness of the strengths and challenges of neurodivergent students, to challenge the overarching norms and assumptions embedded in the graduate school experience and build more open pathways of communication.

Graduate program administrators may provide faculty development that focuses on fostering an environment where there is open dialogue between students and advisors, as well as breaking the stigma associated with discussing mental health, so that students feel comfortable coming forward and seeking needed supports. One feature that may be key in providing this type of environment is the adoption of a strengths-based approach toward neurodiversity that challenges the predominant deficit-based narrative toward neurological variations and empowers

neurodivergent students to leverage their strengths in the academic and research environment. If neurodivergent students feel that their strengths are valued, they may be more likely to build positive relationships based on honest communication about their experiences. By creating an environment in which students may "remove the mask," programs may reduce the cognitive and emotional burden carried by neurodivergent students who are working hard to make it in graduate programs that weren't designed for them.

Conclusion

This qualitative study used thematic analysis to examine the experiences of 25 neurodivergent students in graduate STEM programs at a large, R1 university. It explored the unique stressors they face, such as the invisibility of their neurological diversity, stigma, and pressure to mask their neurodivergent traits to fit in with their neurotypical peers. Key findings include:

- Neurodivergent students feel pressure to avoid negative perceptions, especially within the advisor-advisee relationship.
- As neurodiversity is invisible, students may mask their neurodivergence due to stigma and fear that if deficit-based assumptions were applied to them, they might be perceived as less capable and thus miss out on financial support and career opportunities.
- The additional stress related to overwork and masking may contribute to significant mental health challenges including anxiety and burnout.
- Graduate program administrators are in a position to provide faculty development to increase awareness of these challenges and build in policies that provide needed flexibility to support neurodivergent graduate students.
- Additional studies are needed to understand how the intersection of neurodiversity with other underrepresented identities including gender and race impact the graduate student experience for STEM students.

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